Selfishness need not be bad

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摘要： We focus on an analysis of the inefficiency of equilibria for routing games. This inefficiency is usually measured by the *price of anarchy* (PoA) that is defined by the worst-case ratio of the equilibrium cost over the socially optimal cost. In principle, this PoA can be arbitrarily large. In particular, Roughgarden et al. has ever shown a worst-case upper bound of $\Theta(p/\ln p)$ for the PoA when the routing network has polynomials of degree at most p as its arc latency functions. However, recent experiments with real traffic data demonstrated that the empirical PoA is usually very close to 1. This means that selfish routing need not be so bad in practice.

This talk aims to explain such a peculiar phenomenon from experiments. We show for routing games with regularly varying latency functions that the PoA converges to 1 with the growth of the total travel demand. Regularly varying functions are extensive, including e.g. all polynomials, logarithms, and their sums and compositions. This convergence thus applies to almost all popular routing games in practice. Besides, we demonstrate on a simple routing game with BPR latency functions that the convergence will be very fast, and its rate depends crucially on the growth pattern of the demands.

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